

INL's Vadose Zone Research Park

Purpose of the park

Predicting fluid and contaminant transport in the vadose zone near the Idaho Nuclear Technology and Engineering Center (INTEC) at INL has been problematic due to the complex geology underlying the site. To better understand the controlling mechanism of subsurface fluid transport in 2002 - a system of monitoring instruments were installed in boreholes around the perimeter of newly constructed percolation ponds - consisting of two cells each approximately 14,865 square meters in area. The instrumented region surrounding the ponds and extending to the Big Lost River, has been designated as the Vadose Zone Research Park (VZRP).

Research benefits

Important research needs are being addressed at the Park, including:

- Hydraulic spreading mechanisms
- Mechanisms causing perched water
- Contribution of fast pathways to fluid transport
- Extent of vertical and lateral infiltration
- Aquifer recharge
- Contaminant retardation capacity of porous media
- Big Lost River recharge to the vadose zone.



Aerial view of the VZRP percolation ponds showing initial discharge to the south cell of the ponds in October, 2002.

Instrumentation

Instrumentation extends from the alluvium/basalt interface, approximately 60 meters below land surface (bls), to the capillary fringe, approximately 146 meters below land surface.

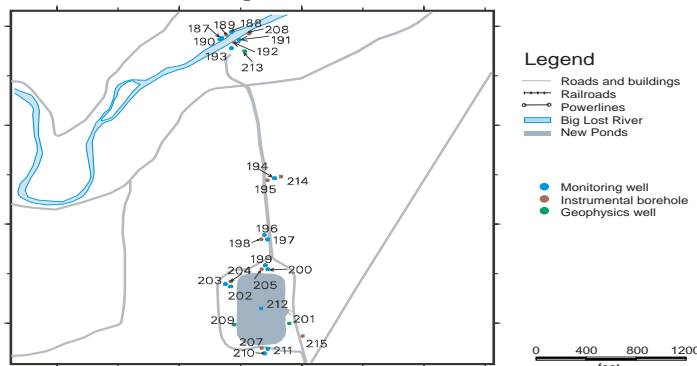
The instrumentation consists of sensors to monitor water pressures, degree of saturation, electrical conductivity and resistivity, surface and

subsurface temperature, and barometric pressure. In addition, vapor extraction ports and suction lysimeters were installed at various depths to collect and analyze water and vapor chemistry.

Data acquisition

VZRP data collection and management web-based system provides real time, on demand access to data,

INTEC Percolation Pond Vadose Zone Monitoring Network



Plan view of the percolation ponds showing monitoring well and instrumented borehole locations.

Science

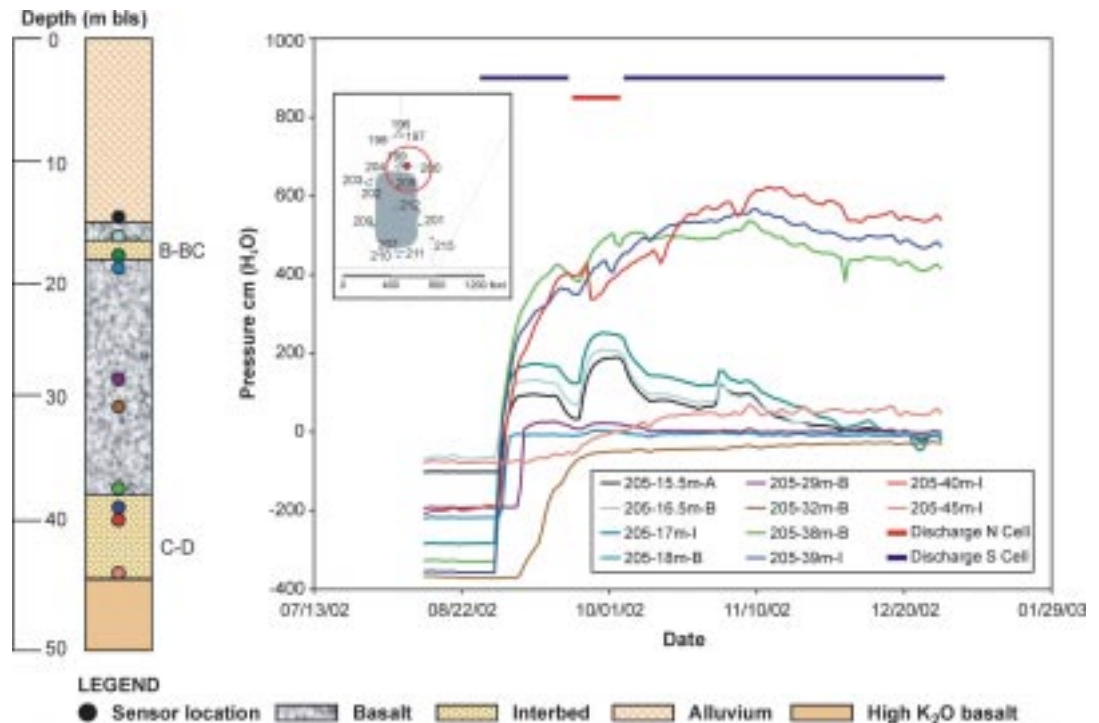
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Example of sensor sensitivity to surface flux and discharge location.

analysis, and reports. These reports are generated on a dedicated, secure server. The server provides user controllable graphing, on demand and automated statistical analyses, user defined alerts and generation of customized reports in pdf format. The web URL for this system is: <http://vzrp.inl.gov>.

Preliminary results

Data collected at the Park since May 2002 indicate that perched water was present beneath the VZRP in the absence of local recharge, that

water infiltration is non-sequential with depth and radial distance from the ponds, and that flow paths are highly sensitive to changes in discharge location and surface flux rates. Recharge has been observed as far away as the Big Lost River and as deep as 87 meters below the ponds.

Future work

- Alluvium characterization
- Coordinated discharge switches

- Tracer and facilitated transport studies
- Carbon sequestration studies
- Pond infiltration / recharge monitoring
- Development of transport numerical model for complex systems
- SECUREarth and FRC proposals to establish site as collaborative, multi-disciplinary field research facility.